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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/600,606	06/23/2003	Nobuhiro Jiwari	740819-1018	9586

22204 7590 01/14/2005

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EXAMINER

DEO, DUY VU NGUYEN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 01/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/600,606

Applicant(s)

JIWARI ET AL.

Examiner

DuyVu n Deo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 October 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Xi et al. (US 6,211,065).

Xi describes a deposition method of amorphous fluorocarbon (claimed fluorine-containing organic film) having a low dielectric constant as low as 2.3 using a fluorine source gas, such as CF₄, C₂F₆, C₃F₈, C₆F₆, as the main component (col. 2, line 4-6; col. 12, line 34-44). Unlike claimed invention, he doesn't describe using fluorine gas such as C₅F₈ or C₄F₆. however, he teaches that other fluorine source can be used as long as the atomic ratios of F:C available in the chamber remain less than 2 (col. 10, line 58-64). It would have been obvious at the time of the invention for one skill in the art to use other fluorine gas such as claimed C₅F₈ or C₄F₆ as long as the atomic ratios of F:C available in the chamber remain less than 2 to deposit the organic film with an anticipation of an expected result.

3. Claims 2-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US 6,057,239), Xi et al. (US 6,211,065), and Imai et al. (US 6,057,247).

Wang describes a method for forming a semiconductor device comprising: dry-etching an oxide film (claimed insulating film); depositing a low dielectric organic film (col. 3, line 40-60). Unlike claimed invention, Wang doesn't describe the etching gas containing C₅F₈, C₃F₆, or C₄F₆ as a main component. However, using gas such as C₅F₈, C₄F₆, or C₃F₆ as the main component for etching oxide film has been known to one skill in the art as taught by Imai (col. 15, line 6-7; col. 20, line 29-32). Therefore at the time of the invention, one skill in the art would find it obvious to etch the insulating film in light of Imai because Imai further describes techniques to etch the insulating film used by Wang in order to etch the insulating film.

Unlike claimed invention, Wang doesn't describe depositing a fluorine-containing organic film. However, he describes using low dielectric film and amorphous fluorocarbon is a low dielectric organic film as taught by Xi. Xi describes a deposition method of amorphous fluorocarbon (claimed fluorine-containing organic film) having a low dielectric constant as slow as 2.3 using a material gas including C₃F₆ as the main component (col. 2, line 4-6; col. 12, line 34-44). It would have been obvious at the time of the invention for one skill in the art to use an amorphous fluorocarbon film because it is a low dielectric organic film, which is used by Wang in order to form a sacrificial layer with an anticipation of an expected result. Even though, Xi doesn't describe using fluorine gas such as C₅F₈ or C₄F₆. However, he teaches that other fluorine source can be used as long as the atomic ratios of F:C available in the chamber remain less than 2 (col. 10, line 58-64). It would have been obvious at the time of the invention for one skill in the art to use other fluorine gas such as claimed C₅F₈ or C₄F₆ as long as the atomic ratios of F:C available in the chamber remain less than 2 to deposit the organic film with an anticipation of an expected result.

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According to the combined method above, the fluorocarbon gas is used in both, etching and depositing processes, on a same semiconductor substrate; therefore, it would have been obvious to do the etching and depositing in a same chamber of an apparatus in order to save processing time, and reduce contamination of substrate when it is moved from one chamber to another.

Referring to claim 4, according the method above, after the step of depositing the fluorocarbon film, the method (Wang's method) further comprises: forming a resist pattern on the insulating film, forming a wiring groove on the insulating film by dry etching using the resist as a mask; removing the resist and the fluorocarbon in the contact hole; and filling the contact hole and the wiring groove with a metal film to form a contact and a metal interconnection (col. 3, line 60-col. 4, line 21).

4. Claims 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsubara et al. (US 6,104,092).

Matsubara describes a method for forming a semiconductor substrate comprising: forming a metal film on the substrate; dry-etching the metal film using a resist pattern; depositing an amorphous carbon fluoride film (claimed fluorine-containing organic film) having a dielectric constant less than 4 (col. 2, line 54; col. 9, line 1-32). Unlike claimed invention, Matsubara doesn't describe depositing using C₅F₈, or C₄F₆ as a main component gas. He describes using other fluorocarbon gas including CF₄, C₄F₈, C₂F₆, C₃F₈ (col. 9, line 60-68). However, It would have been obvious at the time of the invention for one skill in the art to use

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other fluorine gas such as claimed C₅F₈ or C₄F₆ in order to deposit the organic film with an anticipation of an expected result.

5. Claims 7, 8, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsubara as applied to claim 6 above, and further in view of Frank (US 5,277,750).

Unlike claimed invention, Matsubara doesn't describe forming an insulating layer on the metal film and patterning the insulating film using a resist pattern. Frank teaches a method of patterning metal line. He teaches forming an insulating layer such as silicon dioxide on the metal layer and patterning the silicon oxide using a resist pattern (col. 6, line 42, line 58-61). It would have been obvious for one skill in the art to modify Matsubara in light of Frank because Frank describes that the silicon dioxide can be used a hard mask in order to etch the metal.

Unlike claimed invention, above prior art doesn't describe depositing the fluorocarbon film and etching the silicon dioxide and metal films in a same chamber. However, it would have been obvious to do the etching and depositing in a same chamber of an apparatus in order to save processing time, and reduce contamination of substrate when it is moved from one chamber to another.

6. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Matsubara and Frank as applied to claim 8 above, and further in view of Qian et al. (US 6,136,211).

Unlike claimed invention, above prior art doesn't describe the wall of the reactor chamber includes an aluminum layer and a ceramic layer or an alumite-treated aluminum layer. Qian teaches an apparatus that can etch metal and insulating layer such as silicon dioxide. The

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chamber wall is fabricated from a variety of material including metals (aluminum oxide), ceramics, and composite materials (claimed aluminum and ceramic layer) (col. 5, line 31-46; col. 7, line 11-60). It would have been obvious for one skill in the art to use any apparatus that are available to one skill in the art such as one described by Qian in order to process the semiconductor with an anticipation of an expected result.

Response to Arguments

7. Applicant's arguments filed 10/28/04 have been fully considered but they are not persuasive.

Applicant's argument that using C4F6 as a main component provide a layer with a small relative low-k and better adhesion to the underlying film comparing to other gases listed in the rejection is found unpersuasive because there are no factual evidence to show so.

Applicant's argument that applied prior art doesn't suggest using C4F6 or C5F8 is acknowledged. As discussed by the applicant, the motivation is either in the references themselves or in the knowledge generally available to one skill in the art. In this case, it would be the latter reason because the prior art has shown that different fluorine gases can be used for deposition of the low-k layer. In the absent of the factual evidence to show the unexpected result, using any other fluorine gas would be obvious to provide a dielectric layer having low-k with a reasonable expectation of success.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD

January 13, 2005

A handwritten signature in cursive script, appearing to read "George", with a horizontal line drawn underneath it.